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DESIGN AND DEVELOPMENT OF IOT BASED MULTI DEGREE FIRE EXTINGUISHER

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Abstract: Large factories, warehouses, and industrial production facilities always run the risk of fires breaking out. Lack of appropriate firefighting measures could result in disastrous consequences and along with financial losses and might even lead to massive loss of human life. Usual fire protection systems installed in buildings have the following disadvantage. They spray small amounts of water from each sprinkler which may not be enough to put out the fire. The sprinklers are not targeted and spray an entire floor or building ruining computers, furniture and paperwork. While this sprayer gun can spray water in desired quantity only at fire outbreak point to stop fire without ruining complete office furniture and electronics. This demo version is made to be remote controlled from few meters but future version will operate remotely from fire dept. Fire monitors and sprayers are an aimable and controllable high-capacity water jet used to deal with large fires. Unlike Fire extinguishers, Fire Monitors are permanently installed and cannot be moved. While traditional fire monitors systems need a human operator to change the direction of the water jet and aim it appropriately, this fire monitor has been equipped with RF control. There by allowing the user to operate it from a safe distance. The system makes use of a Motor coupled with a powerful sprayer motor with piping system and onboard wireless fire sensing sensor to run this system. Another motor are used to control the nozzle direction movement. The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives user commands and operates the motors to achieve desired motion. Also, the receiver operates the pump motor to start and stop the spray. The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve 360 Degree water spray coverage.

I. INTRODUCTION

Nowadays, machinery and robotic design become important in helping human. This Fire Protection system was design to help people in any destructive burnt situation where this fire protection system can extinguish burnt area immediately using autonomous system. This autonomous system will be designed using programming in PIC18F4550 and others additional circuit. In real life, destructive burnt area often happens without our realization. Therefore, this type of robot will require a high demand in the market because of its usefulness to the human as well as the environment transmit fire information to cell phone using controller. The objective of the project will be to design a SMS electronic Fire Protection system toolkit which can replace the traditional Fire Protection system.

The user may use a wireless remote to transmit movement commands. The receiver circuitry mounted on system receives users commands and operates the motors to achieve desired motion. Also, the receiver operates the pump motor to start and stop the spray. The sprayer nozzle can also be adjusted to adjust the water spray outlet. The sprayer mechanism is built to operate in a 2 DOF operation to adjust position in x and Y directions and achieve 360 Degree water spray coverage. Under the rather broad heading of fire protection systems, this module will examine the main components of alerting, suppression, and containment features and systems. Consideration of these systems is a natural adjunct to a discussion of hazards and building construction features. The primary components we will examine are fire alarm systems, fire detection and notification systems, suppression agents and systems, water distribution systems, automatic sprinkler systems, standpipe and hose systems, and portable fire extinguishers.

Fire Protection systems are a very important part of safety in any operating plant as it provides a reasonable degree of protection to expensive equipment, property, documents, life, and inventory during a fire event. For Oil & Gas, Refinery, or plants those deals with Petroleum or similar flammable products, it must have to be in place to avoid major loss during uneven circumstances.

2.OBJECTIVES:

- To prevent and suppress unwanted fires by rendering prompt and efficient services so as to keep the loss of life and property to the minimum
- To conduct fire safety inspection in hazardous occupancies and to advise management so as to reduce risk by fire.
- To impart training in fire prevention, fire fighting and fire protection.
- To spray the water in 2 direction..
- To provide stand by protection at large gatherings and important public and private functions.

- To check the installation of fire protection measures and carry out firefighting and responding to non- fire emergencies due to natural and man made disasters.
- To prevent loss of life and property from fire and non fire emergencies like highway motor accidents, building colapse, landslides, still water rescue, Industrial hazards, spillage and toxic release, inter ail technological hazards and to tender humanitarian services and special services.

3.METHODOLOGY:

The study involved four major activities in estimating the current size of the fire protection system market. Exhaustive secondary research has been done to collect information on the market, peer market and parent market. To validate these finding, assumptions, and sizing with industry experts across the value chain through primary research has been the next step. Both top-down and bottom-up approaches have been employed to estimate the complete market size. After that, market breakdown and data triangulation methods have been used to estimate the market size of segments and subsegments. Two sources of information secondary and primary have been used to identify and collect information for and extensive technical and commercial study of the fire protection system market

Materials required:

- Pump Motor
- Flange
- Gear Motor
- Nozzle
- Solenoid Valve
- Pipes
- Bearing
- Water

Working :

Step 1: The water is sucked from the tank by the pump motor. The electrical energy is converted into mechanical energy.It consists of inlet pipe and outlet pipe..
Step 2: The inlet pipe of 1inch sucks the water from the tank and delivers to the outlet pipe. The outlet pipe of 3/4 inch delivers the water. The solenoid valve present in between the inlet pipe and outlet controls the opening and closing of valves for the delivery of the water.
Step 3: The solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a samll orifice. An electric current through the coil creates a magnetic field.The magnetic field exherts an upwards force on the plunger opening the orifice. .
Step 4: The pump motor is placed upon the flange. The flange is used for the connection of pipe, fitting of motor.The flange can also be a plate or ring to form a rim.
Step 5: The water is then flown to the outlet pipe where nozzle is connected . The nozzle sprays the water where the fire is been caught and detects the fire.
Step 6: A nozzle is device designed to control the direction or charecterstics of a fluid flow as it exits an enclosed chamber or pipe.
Step 7: The water from the nozzle sprays the water in the form of sprinkler or high pressure and detects the fire.

Fire fighting System:

Firefighting System is used to prevent, extinguish, localize, or block fires in enclosed spaces. Automatic fire-fighting systems are installed in buildings and rooms where the fire hazard is comparatively high. A distinction is made between systems that are actuated automatically and operate according to a predetermined program and those that are actuated by an operator; the former is called automatic fire protection systems, the latter fire protection units. An automatic fire-fighting system includes a sensor capable of detecting combustion, alarm signaling devices, fire-extinguishing equipment, starting and stopping devices, and feeders for the fire-extinguishing substance.Atomizers, foam generators, and pipe nozzles form and direct the stream of the fire-extinguishing substance, which may be a liquid, foam, powder, or gas. Fire-extinguishing substances are fed into the system.

Experimental details:

Fire extinguishing process will experience three stages. First, water mist intensifies the flow field disturbances, and increases the flame instantly; Second, more droplets fall into fire plume flow and reduce the flame temperature by absorbing heat, which make the motion resistance of droplets reduced, then the flame is gradually covered by water mist; Finally, water droplets get to the fuel surface through flame area, reduce the temperature of fuel surface and decrease the evaporation of flammable gas, eventually leading to the flame extinguishment. The third stage is the most time consuming. In order to investigate the effects of the new multi-component additive on fire suppression and to determine the optimization value of the additive, a series of experiments were conducted wherein the additive concentration varied from 1% to 5%. From Table 2 it can be seen that with the increase of multi-component additives content, the fire extinguishing time fell rapidly, and then became to be stable.

Main parts used in this project

Pump Motor:

A Motor pump is a mechanical device, used to move the liquids/gases from one place to another by using mechanical action. The working principle of the water pump is, it converts the motor's energy from mechanical to fluid flow. These are classified into various types based on the technique they use for supplying the liquid like direct, gravity and displacement.

Solenoid valve:

A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves.

Nozzle:

A nozzle is often a pipe or tube of varying cross sectional area, and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzle, the velocity of fluid increases at the expense of its pressure energy

Flange:

A flange can also be a plate or ring to form a rim at the end of a pipe when fastened to the pipe (for example, a close flange). A blind flange is a plate for covering or closing the end of a pipe. A flange joint is a connection of pipes, where the connecting pieces have flanges by which the parts are bolted together. Piping components can be bolted together between flanges. Flanges are used to connect pipes with each other, to valves, to fittings, and to specialty items such as strainers and pressure vessels.

Pipes:

These pipes are used to transfer and suck water from the reservoir or a tap. The green pipe used here is used to suck the water from the reservoir and the orange pipe is used to deliver the water. The Green pipe is also called as the inlet pipe and the orange pipe is also called as the outlet pipe of this system.

Gear Motor:

A gear motor develops torque due to hydraulic pressure acting against the area of one tooth. There are two teeth trying to move the rotor in the proper direction, while one net tooth at the center mesh tries to move it in the opposite direction. In the design of a gear motor, one of the gears is keyed to an output shaft, while the other is simply an idler gear. Pressurized oil is sent to the inlet port of the motor.

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Construction:

Type of Fire	Australia	European	North America
Fires that involve flammable solids such as wood, cloth, rubber, paper, and some types of plastics.	Class A	Class A	Class A
Fires that involve flammable liquids or liquefiable solids such as petrol/gasoline, oil, paint, some waxes & plastics, but not cooking fats or oils	Class B	Class B	Class B
Fires that involve flammable gases, such as natural gas, hydrogen, propane, butane.	Class C	Class C	
Fires that involve combustible flame, such as sodium, magnesium, and potassium.	Class D	Class D	Class D
Fires that involve any of the materials found in Class A and B fires, but with the introduction of an electrical appliances, wiring, or other electrically energized objects in the vicinity of the fire, with a resultant electrical shock risk if a conductive agent is used to control the fire.	Class E[1]	(Class E) now no longer in the European standards	Class C
Fires involving cooking fats and oils. The high temperature of the oils when on fire far exceeds that of other flammable liquids, making normal extinguishing agents ineffective.	Class F	Class F	Class K

Pump Motor:

Capacity: 1/2 HP

$$HP = \frac{GPM * HEAD * SPECIFIC\ GRAVITY}{3960 * EFICIENCY\ OF\ PUMP}$$

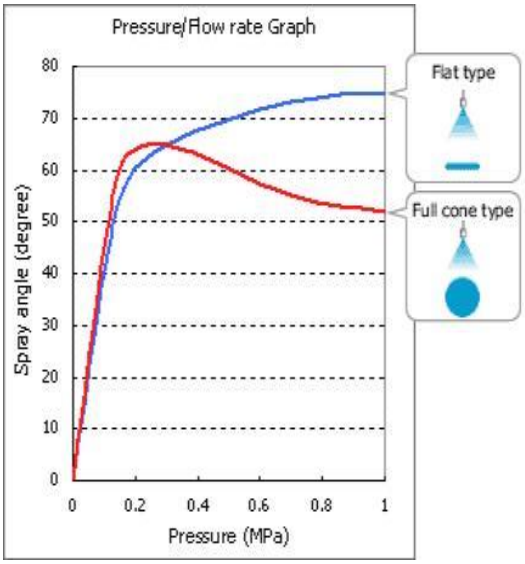
Piping:

For 1 inch: Radius: 0.5 inch
Length: 600 inches
Volume: 3.141*radius*length= 471.24

External pipe surface; 3.141*Outside dia/12
Internal pipe surface: 3.141*inside dia/12

For 3/4 inch: Radius: 0.375 inch
Length: 192 inches
Volume: 3.141*radius*Length=84.807

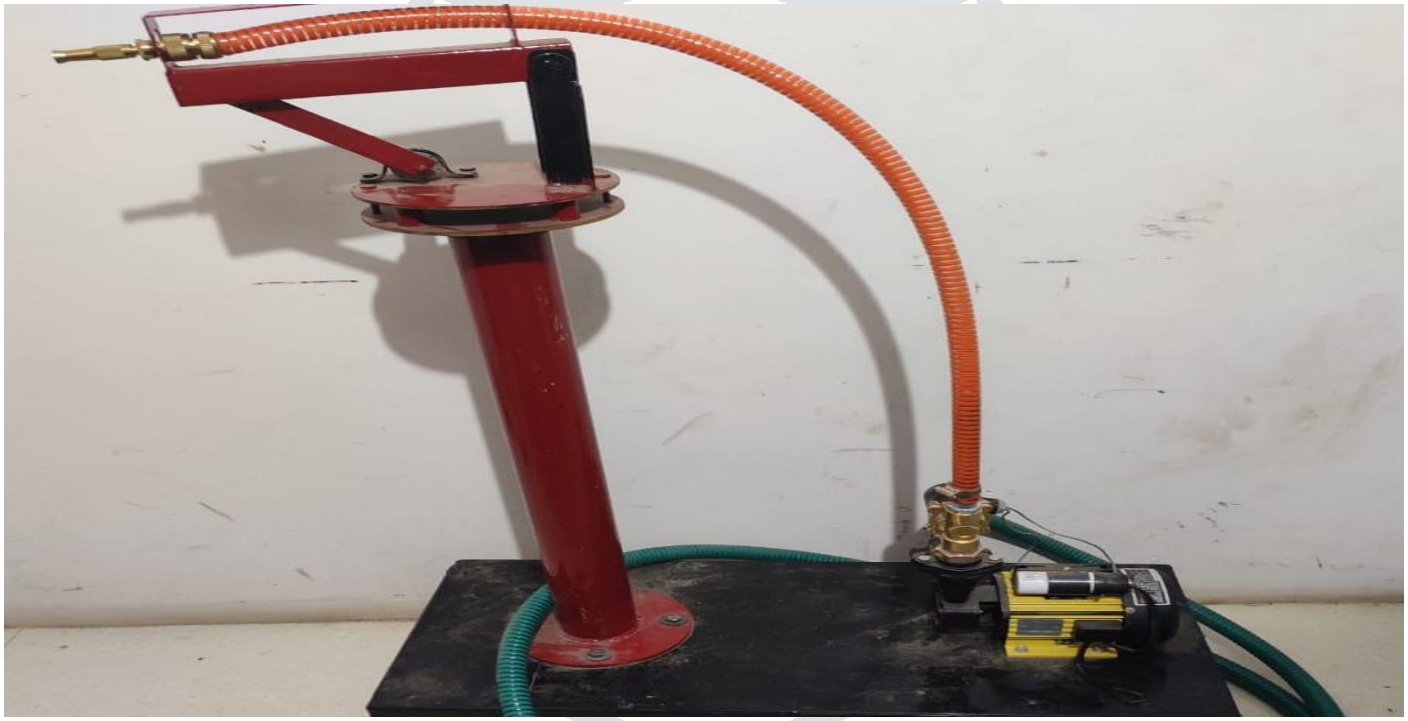
External pipe surface: 3.141*Outside dia/12
Internal pipe surface: 3.141*Inside surface/12



PROJECT OUTCOME

Fire has always been a devastating phenomenon but the technology advancements it become easier to tackle it. Firefighters try their best to respond quickly to case of fire and event put their lives at risk of they endeavor to save human life and protect property fromthe fires. Some attempts have been made to automatic fire fighting for the navy (ship board autonomous firefighting robot). This paper describes one such solution to the problem of fire fighting with help of 360-degree fire protection system.

In conclusion there are many possible ways to put out fires but it always safer to use the constantly this idea to reduce the involvement of fire fighters thereby decreasing the risk of physical injuries and life threats. Comparing this prototype with the existing technology we implement the sensor and wireless technology. Nowadays the firefighting technologies are fully manual. in scope of future, we implement wireless technology to control the fires.
Another advancement could be to use substances other than water such as carbon- di-oxide or fire extinguishing powders by mounting a spray system like a fire extinguisher on top of the system.



Conclusion

Fire has always been a devastating phenomenon but the technology advancements it become easier to tackle it. Firefighters try their best to respond quickly to case of fire and event put their lives at risk of they endeavor to save human life and protect property fromthe fires. Some attempts have been made to automatic fire fighting for the navy (ship board autonomous firefighting robot). This paper describes one such solution to the problem of fire fighting with help of 360-degree fire protection system.
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